## Session 6A: Post Class Test

1. The following is data that you have collected on the up and down movements in a stock index over nine hundred trading days, classified by the direction of the moment (up or down) as a function of the change (up or down) in the index the prior day:

| | | *Day 2* | | |
|---|---|---|---|---|
| | | Up | Down | Total |
| *Day 1* | Up | 260 | 220 | 480 |
| | Down | 220 | 200 | 420 |
| | Total | 480 | 420 | 900 |

   a. Over this entire time period, estimate the probability of an up day for the market, based upon the data you have collected.
   b. Do your results reject the hypothesis that the market follows a random walk? Explain.
   c. Over this entire time period, estimate the probability of a reversal, where a up day is followed by a down day or vice versa.
   d. Over the entire time period, estimate the probability of a continuation, where a up day is followed by another up day or a down day by a down day.

2. A service that tracks and classifies 400 hedge fund managers, based upon performance, into quartiles has given you access to their rankings across two five-year time periods and a transition matrix (of rankings across the two quarters):

| | | 2016-2020 | | | |
|---|---|---|---|---|---|
| | | *Quartile 1* | *Quartile 2* | *Quartile 3* | *Quartile 4* |
| 2011-2015 | Quartile 1 | 27.00% | 24.00% | 22.00% | 27.00% |
| | Quartile 2 | 25.00% | 26.00% | 27.00% | 22.00% |
| | Quartile 3 | 24.00% | 26.00% | 29.00% | 21.00% |
| | Quartile 4 | 28.00% | 22.00% | 24.00% | 26.00% |

   a. If past performance has no predictive value for future performance, what would you expect the numbers in this matrix to be?
   b. What would you need to see to reject the hypothesis that there is no continuity in performance?
   c. How would your assessment be altered if you were told that there were 40 hedge fund managers in the first group that did not survive into the second time period, and that the service removed them from the rankings?

3. You are thinking of using a PROBIT to estimate the probability that a CEO at a publicly traded company in the US will be fired.
   a. Go through the steps involved in building this PROBIT.
   b. Assume that a PROBIT has been run, using three independent variables: the annual returns on the company's equity in the prior year, the percent of shares held by institutional investors and its operating profit margin. The result is summarized below:
      CEOFIRED = 0.05 - 0.40 (Stock Return in last year) + 0.20 (Percent of shares held by institutions) – 0.30 (Operating Profit Margin) $R^2$ = 15%

If you are looking at a firm whose shares earned a return of -20% in the most recent year, has 60% of its shares held by institutions and has a 10% operating profit margin, estimate the probability that its CEO will be fired next year.

c. What intuitive explanation would you offer for this PROBIT? What are some of the concerns/questions that you might have in using this PROBIT?

4. You have been asked to assess the risk in a multi-stage investment, using a decision tree and have been given the following information:

Step 1: You have to apply for regulatory permission, and it will cost you $50,000 to do so. There is an 80% chance that you will be approved, and a 20% chance of rejection.

Step 2: If you get regulatory permission, you plan to spend $10 million on a small-scale version of the infrastructure and test out the market. Based on what you know now, you expect:

- A 25% chance of worst case: $0.5 million in after-tax cash flow in the next year
- A 50% chance of most likely case: $1.5 million in after-tax cash flow in the next year
- A 25% chance of best case: $ 4 million in after-tax cash flow in the next year

Step 3: In the worst case, you will continue with the investment for only five years, earning $0.5 million a year, and then shut it down. In the most likely case, you will continue the investment for fifteen years, earning $1.5 million a year. In the best case, you will go back for regulatory approval for an expansion; that process will cost $2 million, and there is a 60% chance of approval. If approved, you will invest another $10 million, and generate $ 5 million in cash flow for the next 20 years. If not approved, you will continue with the existing capacity, earning $ 4 million a year for the next 20 years.

b. Draw the decision tree for this investment.

Assuming your discount rate is 8%, estimate the expected value today of that tree (and by extension, whether you will initiate the process today).

5. You have been asked to value a company that operates as a quasi-monopoly in a regulated business, where an impending election may create regulatory change, ranging from a shift that could be very positive for the company (where it will remain a monopoly, but get more pricing power) to neutral (where the status quo prevails) to a one that could be very negative for the company (where competition will be allowed). You have valued the company under all three scenarios:

| | *Expected Operating Margin* | *Value of company* | *Probability* |
|---|---|---|---|
| Monopoly + Pricing Power | 15% | $1,500.00 | 20% |
| Monopoly Status Quo | 9% | $900.00 | 50% |
| Competition | 6% | $500.00 | 30% |

a. Estimate the expected value of the company across the three scenarios.

b. If you were valuing this company with point estimates, what would use as your expected operating margin?

c. Will the value from a point-estimate valuation be the same as your expected value across scenarios, assuming that your point estimates are all computed based upon expected values (like margins in part b)?

d. What are the limitations of scenario analysis to deal with regulatory risk, in general?